

# Establishing a Quantitative Relationship Between Ion and Pulsed-Laser Induced Single Event Soft Errors in Advanced Semiconductor Devices

Completed Technology Project (2014 - 2016)



## Project Introduction

Radiation is a pervasive environmental challenge in space and the upper atmosphere. Ions can interact with microelectronic devices and create unwanted charge leading to malfunction. The radiation effects community has used ion-beam particle accelerators to test for these single event effects in the past, but more recently lasers have been used to test for charge generation effects in the device as well. Engineers have asserted that lasers can predict what will happen in a radiation environment, but at this time it is unclear to what extent lasers can be used to approximate the threat to semiconductor devices during missions. The question to be asked is to what extent can laser light which uses optical or near-infrared photons to generate charge compare with the charge generated by ionizing particle radiation? Answering this question will be by using theoretical and computational science supported by experiments as a comprehensive framework to compute the complex interactions of charge in a semiconductor device when exposed to a pulsed laser. The framework will be one that NASA can use to better select the parts for their missions in a safer, cheaper way than before. If the hypothesis is disproven then it will be known that lasers are insufficient means of predicting charge deposition in the device and ion-beams must be used.

## Anticipated Benefits

This framework will be one that NASA can use to better select the parts for their missions in a safer, cheaper way than before. If the hypothesis is disproven then it will be known that lasers are insufficient means of predicting charge deposition in the device and ion-beams must be used.



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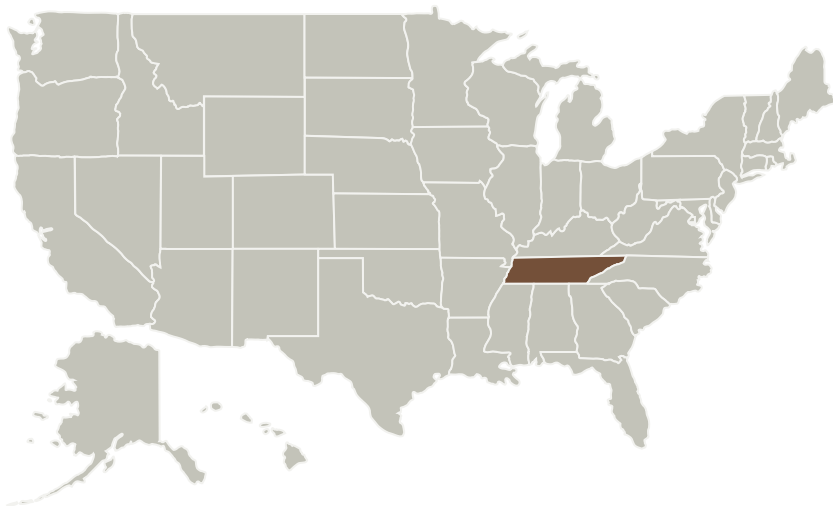
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## Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Vanderbilt University	Supporting Organization	Academia	Nashville, Tennessee

### Primary U.S. Work Locations

Tennessee

## Project Website:

<https://www.nasa.gov/directorates/spacetech/home/index.html>

## Organizational Responsibility

### Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

### Responsible Program:

Space Technology Research Grants

## Project Management

### Program Director:

Claudia M Meyer

### Program Manager:

Hung D Nguyen

### Principal Investigator:

Robert G Weller

### Co-Investigator:

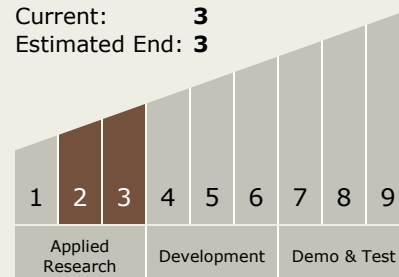
Kathryn Hayes

## Technology Maturity (TRL)

Start: 2

Current: 3

Estimated End: 3



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## Technology Areas

### Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
  - └ TX12.5 Structural Dynamics
    - └ TX12.5.3 Shock & Impact